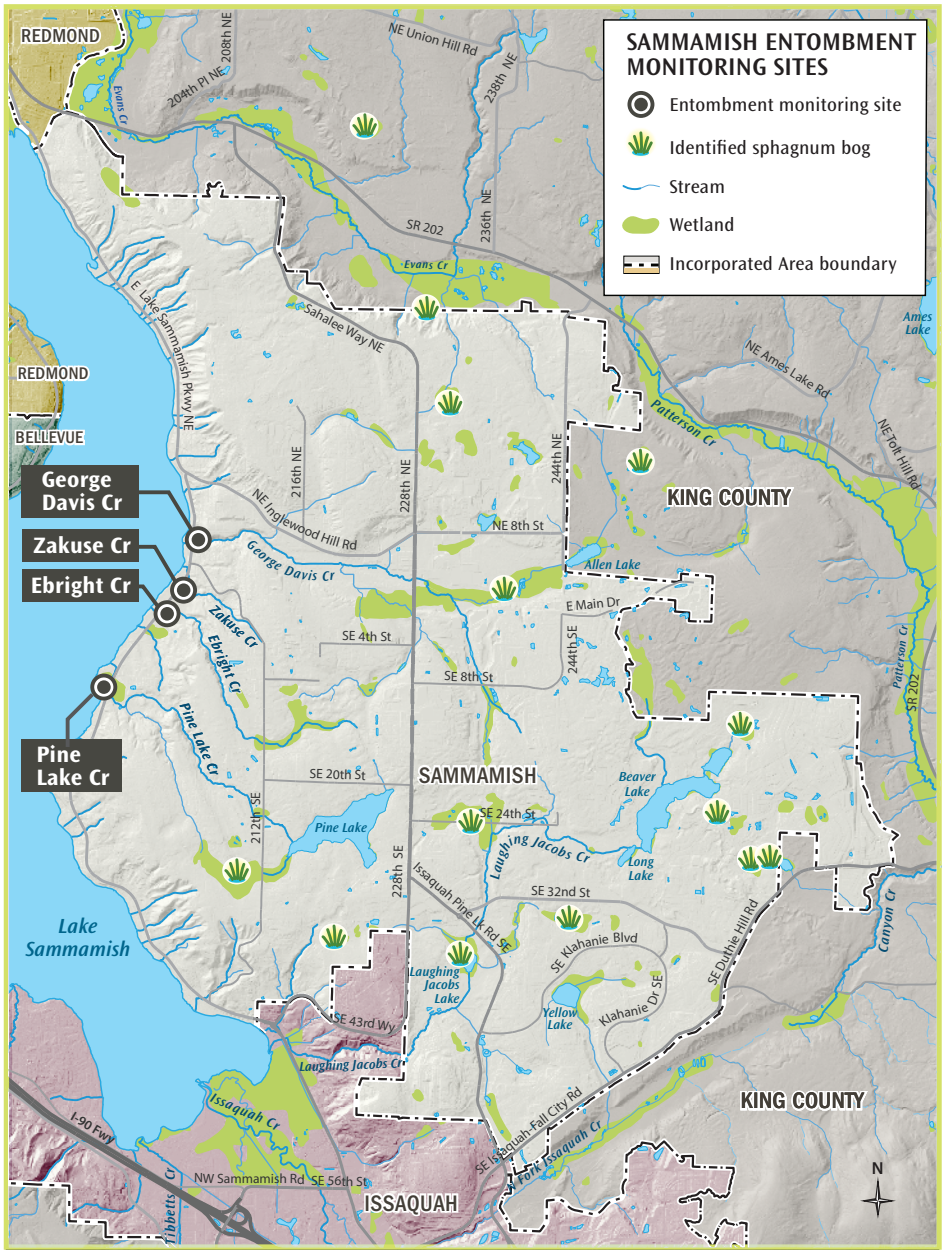
Science & Technical Support Section's
SciFYI
King County
Department of Natural Resources and Parks
Water and Land Resources Division
A science section digest of current environmental issues in King County
February 2020

Measuring sedimentation on kokanee spawning beds to inform effective restoration

By Wafa Tafesh

Kokanee salmon, the little red fish that span less than half the length of its sockeye relative, are a special part of King County's variety of life. Rather than migrating to the ocean to feed or spawn, kokanee salmon live out their entire life in freshwater. With the number of adult kokanee returning to Lake Sammamish falling drastically from 6,988 in the 2015-2016 season to only 19 the following season, fish ecologists have hypothesized that fine sediments, through the process of sedimentation, may be one factor harming the kokanee populations. Sedimentation is the movement of finer sediments that settle on stream or lake beds. The finer sediments, such as silt and clay, may be smothering the eggs while they are developing in the gravel nests (known as redds).



During the kokanee spawning season (November to May), fertilized eggs incubate in gravel streambeds where they depend on water flowing continuously through the gravel. The flowing water carries oxygen to the developing fish and washes away waste products. These important processes can be blocked by sedimentation. In this scenario, sedimentation occurs when fine sediments deposit on and around the larger gravel in the spawning beds where the kokanee eggs incubate. This can suffocate the developing fish and possibly trap the young fish trying to emerge into the river. This

(continued)

suffocation, called entombment, has not been studied in the Sammamish watershed, so we don't know whether it is occurring, nor do we know which streams are most affected in the Sammamish watershed.

King County scientists recently launched a new study to address the questions around the possible impacts of sedimentation on kokanee survival. Daniel Nidzgorski's, "Monitoring Entombment of Kokanee Spawning Beds Sampling and Analysis Plan," summarizes a study designed to look at sedimentation impacts on kokanee's spawning beds in streams of Lake Sammamish. It is designed to answer the following questions:

- How does sedimentation vary within a stream?
- How does entombment compare among streams?
- And what trends are we seeing over time?

Nidzgorski's study, being done at four creeks (Ebright, George Davis, Pine Lake and Zackuse), will provide data to answer these questions. (See map.)

The entombment monitoring sites were chosen because they are located where the stream slope flattens out. As water and sediments flow downstream, we can expect much of the sediment to settle out in flatter stretches where the water slows down.

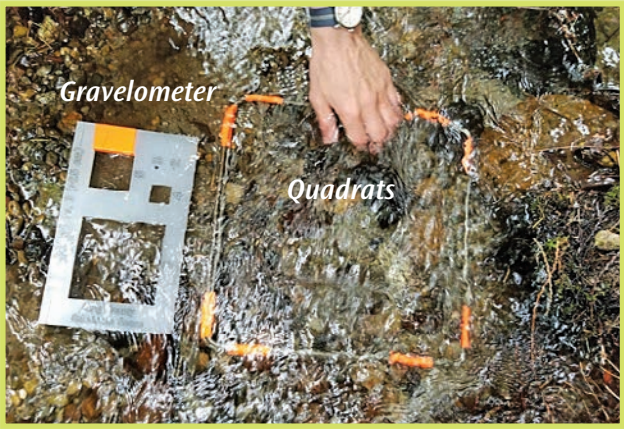
To see how sedimentation changes along the stream we are measuring sediment particle sizes using a gravelometer (see photo) and answering four questions at each monitoring sites on each stream (Crouse et al, 1981):

1. What is the most common particle size?
2. What is the second most common particle size?
3. What is the particle size immediately surrounding the most common particle size?
4. What is the percent of coverage of the most common particle size?

We began the study in 2019. At each sampling point, after the quadrat was set, we got to work, lifting larger pebbles out of the stream and matching them to the gravelometer; seeing what smallest opening in the gravelometer it could fit through. Embeddedness was measured a little differently. We left the larger pebbles in place within the stream and estimated how much of their surface area is covered or surrounded by the sand or finer sediments.

Later, substrate scores for each stream's sampling points were added up from the sum of the answers to the four questions. These scores will help us understand if the sedimentation is in fact harming kokanee embryo survival and health. By focusing on physical sedimentation

(continued)



Sampling tools

A **gravelometer** gives us a systematic way to categorize particle sizes so we can compare changes over time. Particles are given a score from 1 (fine organic material) to 7 (10-25 cm, roughly the size of a soccer ball) using the gravelometer. Embeddedness, the amount of a particle's surface that is surrounded by sand or finer sediments, is scored from 1 (completely or nearly) to 5 (not embedded).

Quadrats, a standard sized frame of 30-cm by 30-cm, are set up at several sampling points at each monitoring site. Here we would sample the middle of the stream, to the left of the middle point, and to the right. We repeated this every 10-meters, moving upstream, for a total of 11 sampling points giving us 33 quadrats per stream.

impacts on stream spawning habitat, we are able to gather data to help inform development and restoration work in the watersheds.

We have at least five years of data collection and observing the habitat of kokanee salmon to go before we will be able to answer the study questions. With enough data, it will be possible to prioritize watersheds, and monitor the effectiveness of restoration efforts or impacts from other changes in the watershed. Ultimately, we are trying to understand more about how to improve adult living habitat conditions in Lake Sammamish, and ensure that kokanee have ample, healthy spawning habitat in the streams. ■

About King County's SCIFYI

King County
Department of Natural Resources and Parks
Water and Land Resources Division
Science and Technical Support Section

Clean Water Healthy Habitat

Section Manager: Dave White

Newsletter Coordinator: Chris Knutson

Designer: Laurel Preston

Web Design/Production: Fred Bentler

Send questions, comments and future story ideas to:

- Debra Bouchard – debra.bouchard@kingcounty.gov, 206-477-4650
- Kate O'Laughlin – kate.olaughlin@kingcounty.gov, 206-477-4789
- Deb Lester – deborah.lester@kingcounty.gov, 206-477-4752

Available on the Web at: www.kingcounty.gov/SciFYI

File: 2002_9792L_SciFYInews.indd 1202M

Para pedir una traducción: 206-477-4800

Alternate formats available

206-477-4800 TTY relay: 711